



**ESKİŞEHİR TECHNICAL UNIVERSITY**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**EEM 413-414 PROJECT LIST FOR 2022-2023 ACADEMIC YEAR (After Summer School)**



PROJECT ID	PROJECT TITLE	ABSTRACT	TEAM QUALIFICATIONS
PRJ05	Edge Detection by Using Petri Nets	The purpose of this project is to develop a methodology, based on Petri net, for the edge detection. The steps of this study are given as follows; reading the image file, converting the suitable for the mathematical model of Petri nets, constructing the Petri net to implement the edge detection algorithm and achieving simulation and real-time application results. This design will be realized on MATLAB.	<b>3 Students from one of the areas below :</b> MATLAB Design (1 Student), Methodology Design (1 Student) System Modelling (1 Student)
PRJ07	Device-free Fall Detection Using RF Signals	Nowadays, the number of elderly people is increasing, which makes elderly care services more important. One of the biggest threats for the elderly living alone at home is falling. For this reason, the fall detection system is a very crucial and life-saving technology for the elderly population. Conventional fall detection systems limit people's comfort and life. In this project, a device-free fall detection system that detects the falling of a person using analysis of radio frequency (RF) signals while the person itself is not required to carry a wireless device is proposed. It is also aimed to design a system that will immediately alert carers/emergency services so that help can arrive quickly after the person has fallen.	<b>1 Students from one of the areas below :</b> Signal Processing/Machine Learning (1) Telecommunication (1) Software Development (1)
PRJ10	AI-based Smart Zoom for Military Applications	Increasing the spatial resolution of an image or video can be a very important application in security or military applications. For example, a drone for military surveillance (UAV) needs expensive and bulky lens systems to produce high-resolution images with good detail from a safe altitude. For this reason, it will be of great benefit to replace this lens system with artificial intelligence supported software in order to provide high resolution images. The most basic form of this process is called upsampling and is accomplished by interpolation methods. These methods do not use multiple images or external data as they try to estimate the values of new pixels using only the existing data in the image. Super resolution, on the other hand, aims to obtain a high-resolution version of an input image, solving the same problem by using available information from multiple images of the same scene. In recent studies, machine learning methods are emerging to enable the use of data from large databases to obtain a high resolution image. In this project, potential teams will develop AI architectures for super-resolution applications and optimize them so they can run on edge devices.	<b>1 Students from one of the areas below :</b> Computer Vision (1) Machine Learning (1) Image Processing (1)
PRJ13	On-Chip Waveguide Investigation Using Optical Fiber Alignment System	The project aims in continuation of the development of automated self-alignment system which will enable coupling of laser light into an integrated optical chip. The same system will also guide the laser light into an Optical Spectrum Analyzer (OSA) and/or photodetector. The hardware to be controlled simultaneously consists of two 3-D motorized stages, diode laser controller, photodetector, and Optical Spectrum Analyzer. The project will be conducted in a research lab environment.	<b>1 Students from one of the areas below :</b> Electronics: Electronics Design; Optoelectronics Interest and success in EEM210 and EEM403 are critical for the implementation of the project.
PRJ17	Autonomous Vehicle Design	In this project, an autonomous vehicle will be designed to satisfy certain tasks which will be determined depending on success of OKTA (otonom kara temizleme araci) and discussions with the firms covering the hardware/software costs of OKTA.	<b>3 Students from one of the areas below :</b> It is expected from the students having interests at least in Embedded systems, image/signal processing, control and instrumentation, digital systems.
PRJ18	Recognition of bird species from their sounds using frequency analysis and deep learning	Purpose of this project is to recognize specific bird species from their sounds. Frequency analysis is necessary to filter bird sounds from ambient sounds. Therefore, frequency analysis will be used for preprocessing. The filtered bird sounds will be used to train an appropriate deep network architecture. After obtaining a sufficient deep network architecture, trained neural network will be integrated with preprocessing algorithm and tested with new bird sounds.	<b>1 Students from one of the areas below :</b> Signal Processing (1 Student), Machine Learning (1 Student) Telecommunication (1 Student)

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PRJ22	Interpretable Deep Learning	Current deep learning methods, including convolutional neural networks, tend to be considered as black-box processes which perform image classification according to obscure feature generation processes. Despite their reportedly high classification performances, their practical usage in critical areas becomes undesired or dangerous because of this “non-interpretability”. The team is expected to explore the stages of evaluating interpretability of the network, as well as training/validation/test design that may improve network interpretability. The outcome will be a deep neural network training paradigm that may be successfully applied to image classification regardless of the particular problem.	<b>3 Students from one of the areas below :</b> Solid background on math skills: linear algebra and signal processing. Familiarity in programming for machine learning; knowledge on CNN platforms in Python is a plus.
PRJ23	Restoration by GAN based in-painting	Several historic/archaic artefacts could become destroyed or ruined in time. Depending on the discipline, the dedicated expert is supposed to carefully restore the artefact according to the artistic and historic concerns. For example, if the artefact is a ruined historic stone bridge (say from the Byzantine era), an expert architect its restoration. If the artefact is a cloth from early Islamic era, an artist needs to restore it. Recently, GAN-based deep neural networks have been used to convert paintings to images with different artistic styles. The project should aim to apply that idea to convert images of a group of artefacts into their restored form.	<b>2 Students from one of the areas below :</b> Solid background on math skills: linear algebra and signal processing. Familiarity in programming for machine learning; knowledge on CNN platforms in Python is a plus.
PRJ24	Simulation of Triboelectric Energy Harvesters Performance	The aim of this project is to simulate the triboelectric energy harvester performance. The working principle of triboelectric energy harvester is based on statistic charging of two surfaces. When two materials that differ in being electron donor or acceptor undergo periodic contact and separation, the generation and transfer of electrostatic charges cause a potential difference between oppositely charged surfaces thus driving an alternating current flowing through an external load. Here, students are expected to analyze the performance of energy harvest devices via simulation in terms of material selection, design structure.	<b>1 Students from one of the areas below :</b> Electronics (2 Students)
PRJ25	Design of an ML based smart charging reservation system for EV parking lot.	In metropolitans, the problem of finding available parking slots has changed as finding available parking slots having charging stations due to increasing electric vehicle (EV) deployment. Smart management systems can be used in this manner for obtaining an optimum parking slot in EV parking lots (PLs) considering EV users’ preferences. This purpose of this project is designing a smart reservation system considering the behavior of EV users, parking slot availability (PSA), state of charge (SoC) value of EVs, and PL usage history of EV users. To do this, a machine learning (ML) algorithm will be used in the smart reservation system.	<b>2 Students from one of the areas below :</b> Strong programming capability is suggested. Also, Machine Learning and probabilistic data processing is necessary capability for this project.